Remarks

This Reply is timely filed and is responsive to the Office Action mailed August 11, 2004 (the "Office Action"). In the Office Action, claims 88-102 were rejected and claims 71-87 withdrawn from consideration pursuant to a restriction requirement.

In this Reply, claims 88, 90 and 102 have been amended, the amendments being unrelated to the cited art. New claim 103 directed to a system for converting fuel energy to electricity including a coal gasifier as an alternative to the reformer recited in claim 88 has also been added. Claim 103 specifically recites that the synthesis gas comprises H_2 and CO and otherwise parallels the turbine then separator then first fuel cell for electrochemically oxidizing the lower molecular weight component (H_2) and a second fuel cell for electrochemically oxidizing the higher molecular weight component (CO) recited in claim 88. Support for this new claim regarding coal gasification can be found on page 11, line 6 of Applicants' specification. Claims 71-87 have been cancelled without prejudice. No new matter has been added.

Applicants hereby affirm election of Group I claims 88-102 drawn to a system for converting fuel energy to electricity, classified in class 48, subclass 127.9 with traverse. As noted above, claims 71-87 drawn to a method for converting fuel energy to electricity are cancelled herein.

The Examiner rejected claim 102 under 35 U.S.C. §112, second paragraph, as being indefinite based on the limitation "said natural gas supplied to said reformer at a pressure of at least approximately 40 atmospheres" being inconsistent with the Applicants' specification. Applicants respectfully disagree. Page 5, second paragraph, penultimate sentence, recites that "In the preferred embodiment, the hydrocarbon

pressure supplied to the reformer is approximately at least 40 atmospheres, which corresponds to the gas pressure in a typical gas main." Accordingly, claim 102 which recites" wherein said hydrocarbon containing gas is natural gas, said natural gas being supplied to said reformer at a pressure of at least approximately 40 atmospheres" is clearly consistent with the specification and thus not indefinite. Accordingly, the 35 U.S.C. §112, second paragraph rejection of claim 102 should be removed.

Now turning to claim rejections based on cited art, claims 88, 91, 94-95, 98, and 101-102 were rejected under 35 U.S.C. 103(a) over U.S. Patent No. 6,348,278 to La Pierre et al. ("La Pierre") in view of U.S. Patent No. 4,923,768 to Kaneko ("Kaneko"). Claim 89 was rejected under 35 U.S.C. 103(a) over La Pierre and Kaneko and in further view of U.S. Patent No. 6,375,716 to Burchell et al. ("Burchell"). Claims 90, 96-97, and 99-100 were rejected under 35 U.S.C. 103(a) over La Pierre, Kaneko as applied to claim 88, and in further view of U.S. Patent No. 5,449,568 to Micheli et al. Claims 92 and 93 were rejected under 35 U.S.C. 103(a) over La Pierre, Kaneko as applied to claim 88, and in further view of U.S. Patent No. 4,810,472 to Andrew et al. ("Andrew").

Regarding independent claim 88, according to the Examiner:

> La Pierre discloses a system for converting fuel energy to electricity (Fig. 2), comprising: a reformer (12) for converting a higher molecular weight gas (hydrocarbon, Col. 7, lines 14-18 and methane gas, Col. 7, line 36) into at least one mixed gas stream of lower average molecular weight (col. 8, lines 46-51) comprising at least a first lower molecular weight gas (H_2) and a second gas (CO) said first and second gases being different gases; a separator (14) for dividing said mixed gas stream into a first gas stream mainly comprising said first lower molecular weight gas (via line 40) and a second gas stream mainly comprising said second gas (CO).
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> La Pierre fails to disclose at least one turbine to produce electricity from expansion of said mixed gas stream; and mixed gas stream being directly provided to said turbine from said reformer without additional steps for either compressing or heating said mixed gas stream.

> Kaneko teaches the exhaust gas from a reformer 2 can be fed directly to the turbines (10, 12) to generate electricity (Col. 4, lines 40-45) and collect power energy to be utilized in other area of the power generation system such as the compressor 8 (Col. 4, lines 50-59).
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> The Examiner concludes:
>
> it would have been obvious in view of Kaneko to one having ordinary skill in the art to modify the apparatus of La Pierre with a mixed gas (exhaust gas) fed directly to the turbine as taught by Kaneko in order to drive the turbine to produce electricity for use in other area(sic) of power generation system.

Applicants respectfully disagree with the above claim rejections. However, before reviewing the Examiner's assertion regarding the cited art, Applicants will first review the claimed invention as recited in amended claim 88. Amended claim 88 recites a system for converting fuel energy to electricity, comprising a reformer for converting a higher molecular weight gas into at least one mixed gas stream of lower average molecular weight comprising at least a first lower molecular weight gas and a second gas, the first and second gases being different gases. At least one turbine produces electricity from expansion of the mixed gas stream. A separator is provided for then dividing the mixed gas stream into a first gas stream mainly comprising the first lower molecular weight gas and a second gas stream mainly comprising the second gas. The claimed system also recites *two (2) fuel cells which each produce electricity from different gas streams.* A first fuel cell is for electrochemically oxidizing the first gas stream and a second fuel cell is provided for electrochemically oxidizing the second gas stream. In the preferred embodiment, the fuel energy is provided by natural gas/methane, where the reformate is a mixture of gases, primarily hydrogen and carbon monoxide which are electrochemically oxidized by separate fuel cells with the concomitant production of electricity and heat. As noted in Applicants' specification on page 10 lines 1-5, the

claimed invention provides high efficiency power output from fuels such as natural gas by about 20 to 30 % over existing power systems.

La Pierre is entitled "method and system for supplying hydrogen for use in fuel cells" and discloses a method and system for efficiently producing hydrogen that can be supplied to a fuel cell. The method and system produce hydrogen in a reforming reactor using a hydrocarbon stream and water vapor stream as reactants. The hydrogen produced in the reformate stream is purified in a hydrogen separating membrane to form a retentate stream stripped of H_2 and a purified hydrogen stream. The purified hydrogen can then be fed to a fuel cell where electrical energy is produced and a fuel cell exhaust stream containing water vapor and oxygen depleted air is emitted. In one embodiment, a means and method is provided for recycling a portion of the retentate stream to the reforming reactor for increased hydrogen yields. In another embodiment, a combustor is provided for combusting a second portion of the retentate stream to provide heat to the reforming reaction or other reactants. In the preferred embodiment, the combustion is carried out in the presence of at least a portion of the oxygen depleted air stream from the fuel cell.

La Pierre discloses a single fuel cell for electrochemically oxidizing hydrogen. Specifically, hydrogen 40 produced by separator 14 is supplied to a single fuel cell 52. The H_2 depleted retentate stream 42 provided by the H_2 separation membrane can be provided to the reforming reactor for increased hydrogen yields, or to a combustor for combusting a portion of this retentate stream to provide heat to the reforming reaction or other reactants. La Pierre does not disclose or suggest (i) a turbine for producing electricity from expansion of the mixed gas output by the reformer prior to separation by the separator nor a (ii) second fuel cell to electrochemically oxidize a second gas stream

(the retentate stream) to produce electricity. Although deficiency (i) is correctly noted by the Examiner above, deficiency (ii) is not acknowledged by the Examiner.

Kaneko is used by the Examiner in an attempt to make up for La Pierre's acknowledged deficiency of failing to disclose or suggest Applicants' claimed (i) turbine for producing electricity from expansion of the mixed gas output by the reformer prior to separation by the separator. Kaneko discloses reforming a fuel, which could be natural gas or methane, to a mixture of gases. Kaneko further discloses that the reformate flows under pressure to the anode of a fuel cell and, concurrently, pressurized air flows to the cathode of the same fuel cell, and these gases undergo electrochemical reactions to produce electricity in the fuel cell. The depleted fuel gas and the oxygen-depleted air then flow from the fuel cell to a burner or combustor [2(a) in Kaneko's Figure 1], and this combustor provides heat to drive the reformer. The exhaust gas from the burner or combustor then flows to a gas turbine (10 in Kaneko's Figure 1) to generate electrical power. To facilitate an understanding of Kaneko's system, a mark-up of Kaneko's Figure 1 is provided by Applicants to add some additional clarity to the remarks provided herein.

According to the Examiner: Kaneko discloses a "mixed gas (exhaust gas) fed directly to the turbine" "in order to drive the turbine to produce electricity". Applicants respectfully disagree with this assertion because Kaneko clearly does not disclose or suggest supplying the synthesis gas (synonymous with reformate) to the turbine 10 in order to drive the gas turbine to produce electricity. Instead, as noted above and further clarified by the mark-up of Kaneko's Fig. 1, the reformate gas mixture is directed first to a fuel cell, then to a burner/combustor, and then to a gas turbine. Thus, the gas delivered

to the turbine in Kaneko is the exhaust gas from the burner/combustor, 2a in Kaneko's Figure 1, not Applicants' claimed mixed gas stream prior to separation.

Thus, Kaneko does not make up for La Pierre's acknowledged deficiency of failing to disclose or suggest Applicants' claimed (i) turbine for producing electricity from expansion of the mixed gas output by the reformer prior to separation by the separator. Moreover, as noted above, neither Kaneko nor La Pierre discloses or suggest Applicants' claimed second fuel cell to electrochemically oxidize a second gas stream (the retentate stream) to produce electricity. Accordingly, Applicants submit that amended claim 88 and its respective dependent claims are patentable over the cited art.

New claim 103 which is drawn to a system for converting fuel energy to electricity including a coal gasifier for generating a synthesis gas stream from coal, recites essentially the same inventive arrangement as claim 88. Specifically, claim 103 recites "at least one turbine to produce electricity from expansion of said synthesis gas, a separator for dividing said synthesis gas into a first gas stream mainly comprising H_2 and a second gas stream mainly comprising CO; a first fuel cell for electrochemically oxidizing said H_2 to produce electricity and a second fuel cell for electrochemically oxidizing CO to produce electricity". Claim 103 is patentable for at least the same reasons regarding the patentability of claim 88 as described above.

Applicants have made every effort to present claims which distinguish over the cited art, and it is believed that all claims are now in condition for allowance. However, the Examiner is invited to call the undersigned (at 561-671-3662) if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance. The Commissioner for Patents is hereby authorized to charge any deficiency in fees due

with the filing of this document and during prosecution of this application to Deposit Account No. 50-0951.

Respectfully submitted,

AKERMAN SENTERFITT

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